Important Information on the Use of PTCSL03 Through-Hole PTC Thermistors

MOUNTING INSTRUCTIONS

1. SOLDERING

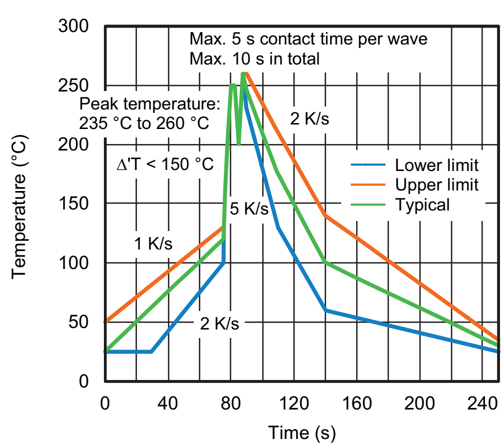
Leaded PTCSL03 thermistors comply with the solderability requirements outlined in IEC 60068-2-20. To prevent damage when soldering leaded PTCSL03 thermistors, care must be taken to prevent excessive heat from being conducted through the lead wires or directly to the thermistor body. The maximum process temperatures, maximum time of exposure, and minimum distances that need to be respected also depend on the material used for the lead wires. For dip, wave, and iron soldering of RoHS-compliant PTCSL03 thermistors, the combined solder conditions listed below should be followed. **Failure to follow the described soldering conditions may result in thermal-electrical damage to material and permanent resistance changes.**

LEADED THERMISTORS: PTCSL03	
	Cu-CLAD STEEL WIRES Ø < 0.55 mm
Wave or Dip Soldering	
Maximum bath or wave temperature	260 °C
Maximum soldering time	5 s
Minimum distance from thermistor body	3 mm
Solder Iron (Manual or Robot)	
Maximum solder tip temperature	320 °C
Maximum soldering iron wattage	30 W
Maximum soldering time	3 s
Minimum distance from thermistor body	3 mm
PiP / PiH Reflow Soldering	**Not recommended**
Maximum thermistor body temperature T_p	Toper. Maximum +25 °C
Maximum exposure time to T_p max.	30 s

The use of resin-type flux or non-activated flux is recommended. The solder tip may not be applied to ceramic (lacquered) surfaces or to an exposed ceramic electrode. No flux can reach the ceramic. Failure to follow the above soldering conditions may result in thermal-electrical damage to material and permanent resistance changes.

For wave soldering, the maximum wave temperature should always be limited to 260 °C and the single wave immersion time should be limited to 5 s max. In the case of double wave soldering, the total soldering time, including the time between waves, should also be limited to 10 s max. The minimum distance between the PTCSL03's lower body and a solder joint should be respected. Proper pre-heating and limitation of the temperature difference between the pre-heating stage and the maximum first wave temperature should be limited to 150 °C.

WAVE SOLDERING PROFILE



2. COLD JOINING AND WIRE BENDING

Cold joining techniques such as crimp splicing can be applied to PTCSL03 thermistors for connector applications and making cable wire extensions. When crimp splicing, care should be taken to avoid causing intermittent contacts. The robustness of the termination leads meets the requirements of IEC 60068-2-21. Before or during mounting, any bending, twisting, or separating of the leads should be avoided. There should be no mechanical stress at the outlet of the coated body. The leads may not be bent closer than 4 mm from the outlet of the coated body or from the seating plane. It is advisable to use stress relief tools during mounting, bending, or cold joining. The bending radius should be at least 2 x the wire diameter. The part should not be exposed to mechanical stresses, including tensile, torsion, or vibration forces, during normal operation in the application.

3. STORAGE - SHELF LIFE

PTC*L thermistors need to be stored in their original packing containers. The storage location and package containers need to be maintained within the following limits:

Storage temperature:	10 °C to 40 °C
Relative humidity (without condensation):	10 % to 70 %

Thermistors must not be stored in corrosive or deoxidizing atmospheres (Cl_2, H_2S, NH_3, NO_x, SO_x, etc.). Avoid storage in heat or direct (UV) sunlight. The presence of ozone or ionizing radiation must always be avoided. Humidity, temperature, and container materials are critical factors that can influence the solderability of the parts. Touching the exposed metal lead wires may change their soldering properties.

Shelf life: properly packaged and stored PTCSL03 thermistors have a minimum shelf life of 24 months after their manufacturing date (DC). Thermo-electrical functionality will not be influenced after longer storage time under the conditions described above. The solderability of exposed leads should be checked before using parts that have been stored for more than 24 months after their manufacturing date.

4. HANDLING

PTCSL03 thermistors must not be dropped. When handling the devices, chip-offs or any other damage must be avoided. Do not touch components with bare hands; gloves are recommended to prevent contamination of the thermistor surface and the ceramic structure during handling. Perspiration or other liquids touching the ceramic body can modify the thermo-electrical characteristics in an irreversible way. Rough handling of PTCSL03 thermistors may result in coating adhesion failures, coating cracks, or chipoffs. Exposed electrodes must not be scratched during handling.

5. SEALING, POTTING, AND GLUING

It is not recommended to pot or seal PTCSL03 thermistors. Ceramic PTC thermistors are sensitive to all materials that are in close contact with them. The specified characteristics of PTCSL03 thermistors are only valid when used in standard mounting and ambient conditions. Sealing, potting, or gluing can only be made with suitable resins that are electrically non-conductive, and chemically and mechanically stable over the whole operating temperature range of the PTC thermistor. If adhesives are used, Vishay recommends silicone-based adhesives or sealing compounds that have long term stability up to the maximum specified operating temperature, or maximum possible body temperature in the application's conditions of use. There must be no mechanical stress exerted on the component due to thermal expansion or compression during the production process (curing / overmolding / gluing) or in the final application. There must be no residual forces or stress on the device during normal operation. As PTC thermistors are temperature-sensitive components, molding sealing or gluing will affect the thermal surroundings and influence the response time, power dissipation, and thermal gradient inside the bulk ceramic material. Extensive testing is encouraged to determine whether molding, potting, or gluing influences the functionality and / or reliability of the component.

6. CLEANING

Cleaning processes can affect the reliability of the component. If cleaning is necessary, mild cleaning agents are recommended. Cleaning agents based on water are not allowed. Washing processes may damage the product due to the possible static or cyclic mechanical loads (e.g., ultrasonic cleaning). They may cause cracks, which might lead to reduced reliability and / or lifetime. Intensive spraying may lead to coating damage. Ceramic PTC material has a porous nature and can absorb liquids easily. Any absorbed cleaning liquid should be removed completely before operation.

7. INSPECTION MEASURING

Resistance Versus (Reference) Temperature

PTC thermistors exhibit a large resistance change depending on the changing surrounding temperature. The change of resistance can range from -1 % to +25 % per degree Celsius. When measuring or inspecting resistance values of PTC thermistors, it is advisable to immerse the thermistor body and its connecting leads in a good thermal conductive homogeneous medium. Such a medium is preferably silicone oil or PFPE non-reactive, per-fluorinated liquid polymers. Water is not recommended because of its electrical conductivity. In any case, when PTC thermistors have been measured in liquids, the measured parts should be discarded, as the fluids can easily enter in the porous ceramic matrix. The liquid medium should be measured with a calibrated thermometer and referenced close to the PTC thermistor body. Measuring PTC thermistors in stirred air is acceptable in most cases where higher tolerance parts are specified. Temperature accuracy levels of ± 0.5 °C are acceptable. PTC thermistors should be measured with very low self-heating (< 0.1 °C or < 10 % of specified D-factor in mW/°C) and with voltage levels below 5.0 V_{DC} (preferred ≤ 1.5 V_{DC}). When PTC resistance values are measured at higher voltage levels, only pulsed voltages can be used to limit the energy load and prevent self-heating (< 0.1 °C).

Dimensional

All PTC thermistor production batches are controlled dimensionally on a statistical basis to guarantee compliance with specifications. When designing a PTC in your application, please verify that the application conditions will not induce any compression stress on the coated thermistor body. For example, if the component must be placed in a low height enclosure, the available height must be larger than the specified maximum mounting height of the PTC thermistor. Bulk packed PTCSL03 thermistors have a pitch specified at the seating plane level. The lead wires can be in a deviating position, though.

Visual

Some PTCSL03s can have uncoated body parts or exposed electrodes and lead wires that do not impact the reliability of the parts. Some slight deformations or indentations on the lead wires at the seating plane level will not affect the reliability of the component. The protective coating layer used on PTCSL03 products has no insulating properties unless specified. Small coating cracks around the lead wire outlets do not impact the reliability of the component. Coating layers extending to part of the leads can hamper solder joint formation on through-plated PCB holes.

8. OPERATION

Use thermistors only within the specified operating temperature range. PTCSL03 thermistors should not be used above their maximum specified voltage and current levels unless specified by derating curves as a function of operating ambient temperature. PTCSL03 thermistors that have been sealed, potted, or glued can have reduced maximum operating voltage levels. Specified dissipation factor, thermal time constant, and response time will change when the parts are not used in a still-air ambient or when sealing, potting, or gluing materials have been applied. Overpowering a PTCSL03 thermistor can cause thermal runaway and fire ignition, short circuits, or open circuit failures. Environmental conditions must not harm the thermistors. Avoid operation of PTCSL03 thermistors in corrosive, deoxidizing, or reducing atmospheres (Cl_2, H_2S, NH_3, NO_x, SO_x, etc.) unless specified. Only use the PTC thermistors under normal atmospheric conditions or within the specified conditions. PTCSL03 thermistors may not be used in vacuums, or at very low or high air pressure. Avoid any contact with water or electrically conductive liquids. For measurement purposes, see the “Inspection Measuring” section (7). Avoid dew formation and condensation unless the thermistor is specified for these conditions.

PTCSL03 thermistors are non-insulated. For non-insulated thermistors, any contact with a metallic or conductive surface could result in a leakage current, disruption, short circuit, or a malfunctioning of the component.

9. FAILURE MODES

For safety critical applications, be sure to provide an appropriate fail-safe or redundancy function in the circuit to prevent secondary (product) damage caused by a malfunctioning or failed PTC thermistor. For every use of Vishay thermistors, it is the customer’s responsibility to consult and respect the Vishay disclaimer notice, which is part of every Vishay product datasheet. If you have any doubt as to the possible failure modes in your application, consult Vishay.

This list of guidelines and information does not claim to be complete, but represents the experiences of Vishay and may be supplemented, adapted, or enhanced at any time.